Using Three-Axle Trucks For Transporting Agricultural Produce

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USING THREE-AXLE TRUCKS FOR TRANSPORTING AGRICULTURAL PRODUCE

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SECTION I

INTRODUCTION

Sugar beets and potatoes are among the major cash crops in Alberta. All of the sugar beet production which comes from the southern part of the province are shipped to a factory in Taber for making sugar. About two-thirds of the total potato production is concentrated in the irrigated areas of southern Alberta. Potatoes are similarly shipped to potato processing plants for further marketing and for the manufacturing of potato products.

Transportation has played an important role in the marketing of sugar beets, potatoes and other agricultural products in Alberta. The original mode of transportation for sugar beets involved the use of horse-drawn wagon to beet receiving stations which were situated beside railway lines, from where the beets were transported by rail to the various sugar beet factories. Wagon delivery disappeared long ago, and the transportation of beets by rail has been abandoned in favour of trucks. This latter change was brought about due to the high cost of moving bulk commodities by rail for short distances, and the greatly improved network of roads in southern Alberta, on which both commercial and farm trucks can operate.

Sugar beet production expanded in southern Alberta to meet the demand for processing of beets at Raymond, Picture Butte and Taber factories. In the 1970's, the Alberta Sugar Company decided to close the Raymond and Picture Butte factories, thus concentrating their processing at the Taber factory. The closure of the two factories in addition to some of the beet receiving stations resulted in hauling beets for much longer distances than before. When the sugar factory at Picture Butte was functioning, the average distance for hauling beets was 7.1 miles (11.4 kilometres) as there were several beet receiving stations. Since the closure of the Picture Butte factory and several beet receiving stations, some producers have to haul beets about 26.4 miles (42.5 kilometres) including 19.3 miles (31.1 kilometres) from receiving stations to the factory in Taber. With longer hauls and more or less the same payload, transportation costs for hauling beets and potatoes have

increased significantly. Besides transportation costs, time required for longer hauls and frequent trips have become major concerns for both beet and potato producers.

With these and other related concerns for hauling beets and potatoes, representatives of the Alberta Potato Commission and Alberta Sugar Beet Growers Association requested the production and resource economics branch to evaluate the possibilities of using three-axle trucks instead of tandems. The tandems and single axle trucks are presently used to transport beets, potatoes and other agricultural commodities. It was also suggested to evaluate other possible alternatives to increase transportation efficiencies which could result in lower transportation costs.

In this report an attempt is made to provide documentation of the existing restrictions regarding the use of three-axle trucks on secondary highways and gravel roads for hauling farm products including sugar beets and potatoes. Efforts have also been directed at documenting advantages and disadvantages of larger units from the farmers' perspective.

Objectives of the Study

1. To describe the present sugar beet and potato hauling systems and the concerns with these systems;
2. To describe briefly, the advantages and disadvantages of three-axle trucks over single axles and tandems; and
3. To evaluate alternatives to the use of tandems and three-axles to improve transportation efficiencies.

Source of Data

Information contained in this report was obtained through discussions with the producer groups and representatives of the Alberta Motor Transport Board at Red Deer. Use of technical information in terms of axle load repetitions and pavement flexibility or strength and impact on bridge structures was deliberately avoided because of the complexity in the interpretation of such information. Some of the information provided by the Motor Transport Board engineers on the potential impact of three-

axle trucks on Alberta roads is based on test runs of these trucks conducted several years ago. Several reports were reviewed to extract information on farm and commercial truck costs.

SECTION II

PRESENT SUGAR BEET AND POTATO HAULING SYSTEMS IN ALBERTA

Sugar Beet Hauling

Sugar beet growers usually haul their beets to the receiving stations where the factory engages commercial trucks to haul beets to the processing facility in Taber. Some of the beet producers who have larger trucks and are not too far from the factory haul beets directly to the factory. The factory pays a hauling allowance on a sliding scale for beets delivered to the factory beyond 5.9 miles (9.5 kilometres). Hauling allowance generally increases with the distance hauled, and those operators with bigger trucks who are in a position to haul beets directly to the factory could benefit from it.

The following table shows the hauling allowance paid by the Taber factory:

TABLE 1

HAULING ALLOWANCES PAID TO PRODUCERS DELIVERING BEETS TO THE FACTORY AT TABER OR TO THE RECEIVING STATIONS

Distance (Miles)	Hauling Allowance $/Tonne	Distance (Miles)	Hauling Allowance $/Tonne
0 - 5.9	Free Zone	18.0 - 18.9	1.11
6.0 - 6.9	0.18	19.0 - 19.9	1.17
7.0 - 7.9	0.29	20.0 - 20.9	1.23
8.0 - 8.9	0.41	21.0 - 21.9	1.30
9.0 - 9.9	0.52	22.0 - 22.9	1.36
10.0 - 10.9	0.61	23.0 - 23.9	1.42
11.0 - 11.9	0.68	24.0 - 24.9	1.48
12.0 - 12.9	0.75	25.0 - 25.9	1.54
13.0 - 13.9	0.81	26.0 - 26.9	1.60
14.0 - 14.9	0.87	27.0 - 27.9	1.67
15.0 - 15.9	0.93	28.0 - 28.9	1.73
16.0 - 16.9	0.99	29.0 - 29.9	1.79
17.0 - 17.9	1.05	over 30	1.85

Although hauling allowance provides an incentive to the farmers to deliver their beets directly to the factory, it is generally the size of the trucks (single-axle or tandem) that discourages the farmers to drive longer distances.

Since the closure of the Picture Butte factory and some beet receiving stations, the distance for hauling beets has increased. Presently, there are only six receiving stations including the Taber factory where farmers can deliver beets. The following is a list of receiving stations and their distance from the Taber factory:

Receiving Station	Distance to Taber
Coaldale	34.9 km (21.8 miles)
Tempest	30.0 km (18.8 miles)
Picture Butte	66.3 km (41.4 miles)
Burdett	43.4 km (27.1 miles)
Vauxhall	37.3 km (23.3 miles)
Taber	-

Sugar beet harvest usually gets underway during the first week of October and is completed before mid-November. Therefore, the farmers have about four weeks to complete the harvest and have their beets delivered to the closest receiving station or factory.

In general, Alberta sugar beet growers have been delivering a greater proportion of their beets in single-axle trucks, the result of which has lead to too many trips and high transportation costs. Sugar beet growers in Alberta pay more to deliver beets because of the:

1) greater number of trucks are used in Alberta per acre of beets harvested,
2) low tonnage per load delivered in Alberta,
3) few loads per day delivered by Alberta growers.

If the farmers switch to larger trucks, transportation of sugar beets can be greatly improved resulting into considerable time savings and lower costs.

Beet and potato producers in southern Alberta have been using single-axle and tandem trucks for hauling produce to the receiving stations or processing facilities. More recently, they have been expressing interest in increasing the size of tandem trucks by adding another axle to make it a three-axle truck. One of the main reasons for increasing the payload capacity of the truck is to lower the ever increasing transportation costs. Larger trucks could reduce gasoline and diesel costs and improve transportation efficiency through increased payload and less time behind the wheel. However, the proposed three-axle trucks if not properly designed, could lead to several problems like inter-axle weight distribution, vehicle instability, tire scuffing, road and bridge damage, etc.

A survey of 50 sugar beet producers in southern Alberta showed that 46 beet producers owned on an average 1.46 trucks per farm used for delivering beets while four producers engaged custom truckers to haul beets directly to the factory. As well, seven of the 50 producers employed the services of custom truckers in addition to using their own trucks for delivering beets. Out of the 67 farm trucks reported in the survey, there were 37 (55.2%) single-axle trucks and 30 (44.8%) tandems. No information was provided on the type or size of custom trucks used.

Potato Hauling

Hauling of potatoes is quite different from that of beets. After harvest, potatoes can be stored on the farm for a considerable length of time. Beets cannot be stored on the farm and have to be delivered to the factory immediately after harvest. Storage of potatoes on the farm depends on the quality of the storage facility. Many potato producers do not have potato storage facilities and therefore tend to deliver potatoes to the various markets right after the harvest. Trucking plays an important role in the marketing of fresh produce. The farmers have made considerable progress in changing from single axle trucks to tandems but the latter are still considered inadequate to meet transportation efficiencies. As the harvest season is very short in Alberta, the farmers' objectives are to reduce the road travel for delivering the fresh produce to the markets, and also to reduce transportation costs.

In order to achieve some transportation efficiencies, the farmers have expressed interest in increasing payload which could only be achieved with the use of larger trucks. Energy efficient trucks combined with increased payload could reduce the over-all transportation costs significantly.

Overloading of Single-Axle and Tandem Trucks

In 1978, a survey of the sugar beet truck traffic volumes was undertaken in southern Alberta which showed that about 86 per cent of trucks hauling beets were overloaded. The 1978 harvest of beets yielded approximately 480,000 tonnes. The movement of this crop from farm to sugar beet receiving stations including the factory at Taber involved approximately 54,500 single unit one-way trips. About 26 per cent of these trips (14,375) were direct farm to factory operations.

In 1978, there were about 11 beet receiving stations including the factory at Taber. After the closure of the sugar beet refinery at Picture Butte in 1977, five of the receiving stations were closed resulting in an increased hauling distance for beet growers. As a result of longer hauls, the farmers have been considering increasing payload in order to reduce the number of trips and the overall transportation costs for hauling beets. Several opinions have been expressed regarding increasing the payload on single-axle and tandem trucks during the peak harvest and delivery season. One of the most common and frequently expressed suggestions is that during the harvest season the government should allow producers to increase payload on secondary highways and the gravel roads so that there would not be any illegal overloading. Another opinion is that highway authorities allow the producers to add another axle to the tandems, making the existing units three-axles.

Restrictions on Three-axles in Alberta

Use of three-axle[1] trucks in Alberta has been very restricted because of the potential for damage to roads. A few special permits

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(1) The proposed three-axle truck would be one more axle added to the tandem and would include three rear axles in addition to the steering axle (in front).

were issued for the use of three-axles in the city of Calgary in order to monitor the impact of these trucks on primary and secondary highways. Tests have shown that three-axles have a damaging effect on roads and bridges because of tire scuffing and poor distribution of weight on axles.[2]

Roads in Alberta, especially in southern Alberta, have been built on soft soil/weak subgrades. As such, the use of three-axles with improper differentials could be very damaging to roadbeds and bridges. Potential damages as a result of the use of three-axles will be discussed in the next section.

When a group of farmers in southern Alberta raised the issue of using three-axle trucks to haul farm products, the Motor Transport Board took the matter to the representatives of the counties and municipalities for discussion purposes. The representatives of the counties and municipalities refused to bear any responsibilities for damages to bridges, oil surfaced and gravel roads. The above and other related concerns prompted the decision by highway authorities of not allowing three-axle trucks in the hauling of farm products.

In a meeting with the producer representatives, it was pointed out that the provinces of Ontario and Saskatchewan allow the use of three-axle trucks on primary and secondary highways; these representatives wanted to know why Alberta does not allow the use of these trucks. In Saskatchewan, the three-axles trucks that are used, mainly to haul potash, are specially built with proper differentials and do not cause any damage to roads and bridges. However, these units do not get any weight allowance in hauling potash. In Ontario, the roads are built on hard rock surface, resulting in use of three-axles being less stressful than in Alberta. As mentioned before, most of the roads in Alberta are built on soft soil surface or weak subgrades. Efforts are underway to develop more uniform regulations for trucks operating on interprovincial highways (appendix I).

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(2) The city of Calgary's experience with three-axle trucks designed specifically for application has proven to be very expensive, especially in the third year of operation because of extensive repair and maintenance. These trucks have appeared to be the most expensive to operate when compared to other fleet. The city plans to retire three-axles from service as soon as these reach maximum years of service for city equipment.

SECTION III

ECONOMIC BENEFIT OF LARGER TRUCKS

The truck has become a vital part of the nations economy. Significant changes in the trucking industry causes repercussions throughout the entire economy. Efficient trucking means lower shipping costs and reduced prices to consumers. Financial pressures on the trucking industry are leading to productivity improvements through larger and heavier trucks. Significant benefits in terms of reduced transport costs and increased fuel efficiency are possible through the use of larger vehicles. Benefits of higher weights are limited to some clearly defined cases. The major beneficiaries of increased gross vehicle weight are shippers of fuel, bulk liquids and chemicals, dry bulk chemicals, forest products and grains.

A few studies have documented potential savings in large trucks being used for commercial operations. By increasing gross vehicle weight (GVW) from 33,600 kg to 50,000 kg and switching from a five-axle unit to a combination unit, the traffic which would take three loads with a semi could be transported in two loads with the combination vehicle. The increase in GVW while maintaining the existing allowable axle weights would allow maximum payload to increase from 20-23 tonnes to 32-34 tonnes or about 60 per cent. It was estimated that the increase in operating costs resulting from increasing the GVW from 33,600 kg to 50,000 kg would be close to 15 per cent while fuel consumption increases would be about 10 per cent. However, increasing the GVW as stated above would result in the overall transport costs being reduced by about 23 per cent and total fuel consumption by about 27 per cent.

Further analysis of the data obtained from a trucking company showed that for 15,092 loads at 33,600 kg and 4,764 loads at 50,000 kg, the average cost was 5.02 cents per tonne per kilometre at lower weight compared to 3.73 cents per tonne per kilometre at higher weight, a reduction in cost of about 26 per cent[1].

(1) G.A. Sparks, R. Couturier, and A.M. Clayton "Increasing Allowable Gross Vehicle Weights on Secondary Highways, a paper published in the proceedings of 18th Annual Meeting of the Canadian Transportation Research Forum, Regina, Saskatchewan, June 1983.

A study completed in the United States reported on the fuel consumption per tonne-kilometre (ton-mile) for different size of trucks. It is a well established fact that big trucks burn more fuel per kilometre (mile) than small trucks, and that big trucks burn less fuel per tonne-kilometre (ton-mile) than small trucks. There are exceptions and limitations to the above statement but it generally holds true within the range of vehicles used in intra- and inter- provincial trucking.

Fuel consumption per tonne-kilometre (ton-mile) is the logical measure of fuel economy. A study conducted by a U.S. government inter-agency group reviewed the state of fuel economy knowledge and developed a curve relating fuel consumed per payload tonne-kilometre (ton-mile) versus gross combination weight (GCW) based on two equations for specific fuel consumption (SFC). Figure 1 shows the curve.

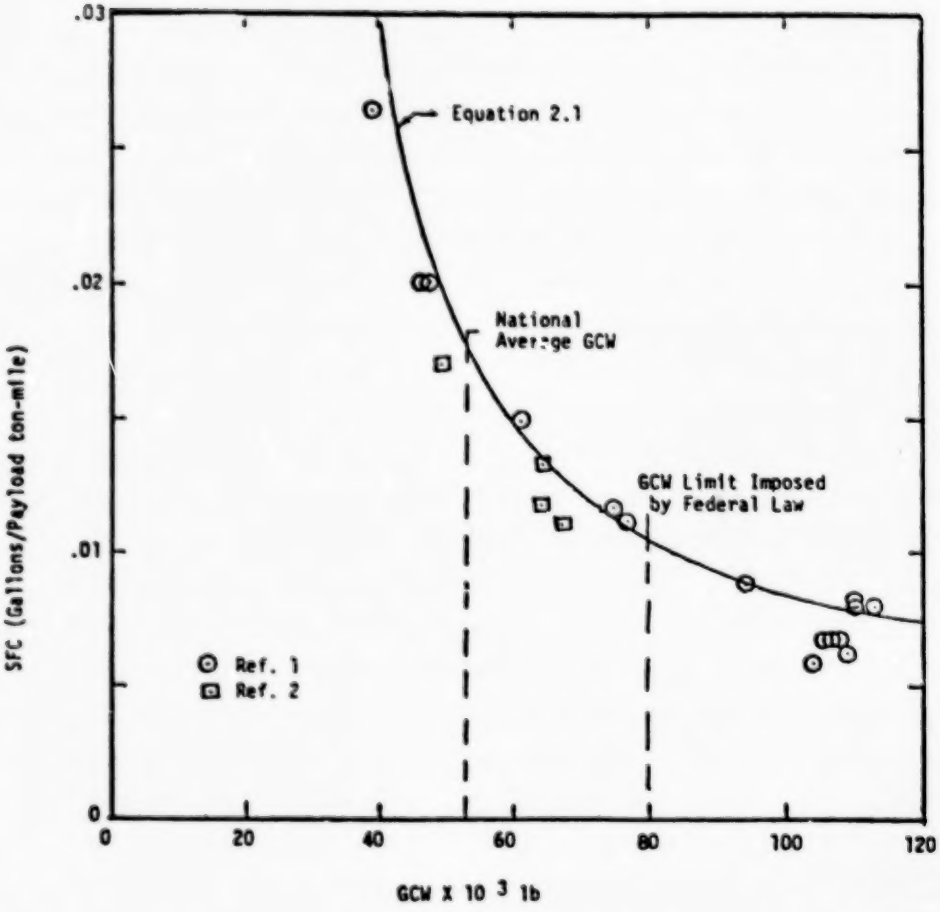
The ratios of net reduction in SFC for various ranges of GCW are shown in Table 2.

TABLE 2

REDUCTION IN SPECIFIC FUEL CONSUMPTION AND GROSS COMBINATION WEIGHT

GROSS COMBINATION WEIGHT kg (lb) FROM		TO		% REDUCTION IN SFC
kg	lb	kg	lb	
18,150	(40,000)	22,680	(50,000)	33.0
22,680	(50,000)	27,216	(60,000)	25.0
27,216	(60,000)	31,752	(70,000)	17.3
31,752	(70,000)	36,288	(80,000)	13.9
36,288	(80,000)	40,824	(90,000)	11.4
40,824	(90,000)	45,360	(100,000)	8.6
45,360	(100,000)	49,896	(110,000)	7.1
49,896	(110,000)	54,432	(120,000)	5.1

Although the above situation does not apply directly to farmers who own smaller trucks, it does reflect a fuel consumption savings which



[1] Fax and Kaye, "Truck Noise IIID, The Economics of Quieting the Freightliner Cab-Over-Engine Diesel Truck," DOT-TSC-75-22, October 1974, p. 8

[2] Hutton, T.D., "Freightliner Comparative Fuel Economy Test," Freightliner R&D Memo. No. 75-03, April 1975.

1 lb. = .4536 K3

S.F.C. x 2.593 = liters/payload tonnes-km

Figure 1: Fuel Consumption Per Payload Versus Gross Combination Weight

Source: U.S. Government Inter-Agency Study of Post 1980 Goals for Commercial Motor Vehicles, 1976.

could be realized by the farmers if the GCW is increased. Depending on the individual's requirements, a farmer with a single axle truck can certainly benefit from fuel savings by buying a tandem or any other larger size of truck.

Besides fuel consumption savings, larger trucks offer reduction in unit costs because of increases in payload and fewer trips (less time behind the wheels). Again, reduction in unit costs and the benefit of fewer trips would require additional investment which the buyers of larger trucks would have to evaluate before making the final decision.

Utilization of Farm Trucks and Costs

Utilization of farm trucks is restricted by the size of the farm, type of farm enterprise and the number and size of farm trucks on the farm. If farmers increase the size of their trucks from single-axles to tandems or from tandems to three-axles, utilization of the latter vehicles would drop unless the larger trucks are used for custom hauling. By increasing the size of a truck, one would expect fewer hours of use hence, lower fuel and labor costs. However, such a situation would also result in increased interest and depreciation costs that are associated with larger investments. An attempt has been made to make a cost comparison between a tandem truck and a three-axle truck (tandem with an additional axle). It was assumed that the addition of another axle to a tandem truck, if done at the farm (as proposed by several producer representatives) would cost about $3,000.[2] The producer representatives claim that farmers are capable of doing such jobs. However, this could be one of the main reasons that such three-axles are not acceptable to the highway regulating authorities. They fear that the three-axle trucks would lack stability because of improper differential between axles, making the vehicle unsafe to drive.

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(2) A commercial truck dealer in Edmonton suggested that the cost of adding another axle to the tandem could range anywhere from $3,000 to $6,000. For the purpose of this study the lower estimate has been used.

Truck operating costs for a tandem and a three-axle which include licence, insurance, depreciation, interest on investment, repairs and maintenance, fuel, lube and driving labor costs are presented in Table 3 for comparison purposes. Because of the additional investment of $3,000, depreciation and interest costs for a three-axle truck would be higher by $378 as compared to a tandem. Similarly repair and maintenance costs would be higher by over $200 for a three-axle truck as these costs are usually associated with investment. Fuel costs for a tandem with an annual utilization of 180 hours, would be about $1,550. Fuel costs for a three-axle truck with a payload capacity of 17 tonnes would be about $1,200 as the hours of truck utilization drop to 142 to deliver the same payload as with a tandem. A farmer switching to a three-axle truck would not benefit by any significant amount over a tandem even with a reduction in driving time of about 21 per cent. If the savings in driving labor costs for a three-axle truck against tandem are not taken into account, there is no benefit of a three-axle truck at all. Furthermore, if the higher estimate of installing another axle to a tandem is used there would be absolutely no economic benefit of having a three-axle truck unless its use can be increased to accomodate custom hauling for other farmers or sharing its use with neighbours.

Advantages and Disadvantages of Three-Axles

Advantages:

1. A shift from a tandem to a three-axle would increase payload by about 25 to 35 per cent, thus, resulting in fewer trips. For example, a 2 000 tonne traffic would require 143 trips with a tandem. With a three-axle, the number of trips would decrease to about 118. Decrease in the number of trips would reduce fuel consumption by about 20 to 25 per cent and reduce driving time by about 21 per cent.
2. Farmers claim that add-on type of axle to the tandem would provide better weight distribution and would not cause any damage to the roads and bridges. Moreover, three-axles are easy to manoeuvre on

TABLE 3

COMPARISON OF TRUCK COSTS BETWEEN
A TANDEM AND A THREE-AXLE

	TANDEM	TANDEM WITH ADDITIONAL AXLE[3] (THREE-AXLE)
Purchase Price[1] =	$46,000	$49,000
Annual Use =	180 hours	142 hours
Maximum Payload Capacity =	14 tonnes	17 tonnes
TRUCK COSTS		
i) Fixed Costs		
License	= $ 45.00	$ 45.00
Insurance	= $ 130.00	$ 130.00
Depreciation	= $2760.00	$2940.00
Interest @ 12%	= $3036.00	$3234.00
Total Fixed Costs	= $5971.00	$6329.00
ii) Operating Costs		
Repairs & Maintenance	= $3220.00	$3430.00
Fuel	= $1544.40	$1218.22
Lube	= $ 232.20	$ 232.20
Labour (Driving)[2]	= $1260.00	$ 994.00
Total Operating Costs	= $6256.60	$5874.42
TOTAL TRUCK COSTS (i + ii)	$12227.60	$12203.42
APPROXIMATE annual volume hauled	= 2 000 tonnes	
Cost per tonne	= $6.11	$6.10

(1) Gasoline, equipped with heavy duty shocks, heavy duty battery, power steering, power brakes, spare wheel and tire. Price obtained from a local truck dealer.

(2) Assuming driver of the truck was paid $7/hour.

(3) Assuming additional cost of another axle is about $3,000.

and around the farm.

3. Three-axle trucks would greatly improve the overall transportation system. As hauling distances increase, the three-axle trucks could reduce shipping costs significantly.
4. Fuel costs represent about 30 per cent of truck operating costs and savings in fuel costs could only be achieved by increasing the truck payload and by using fuel efficient trucks. Farmers claim three-axles could help them achieve fuel efficiency.
5. Single axle trucks are more damaging for the roads, curbs and bridges when compared to tandems, three-axles, semis and trailers. The scale of equivalents is different for tandem axles than for single axles. A tandem or a larger size truck, if properly designed, is generally far less demanding on pavements than the same nominal weight single-axle truck.

When a highway is properly designed, it presumably will require only routine surface maintenance throughout its service life provided the expected number of axle load repetitions is not exceeded. In other words, it will not be damaged by the traffic it is designed to support.

It is a stated fact that trucks do more damage to pavements than passenger cars. This is only true when:

(1) the pavements are underdesigned for the amount of truck traffic that is actually using them;
(2) trucks, through overloading, are imposing heavier axle loads than anticipated; or
(3) other factors not properly evaluated in design have affected the ability of pavements to support traffic.

Disadvantages:

Three-axle trucks have been used on primary highways in Alberta on a trial basis to collect data on the impact of such trucks on the roadways and bridge structures. After consultation with the highway traffic regulating authorities and highway engineers, the disadvantages associated with the use of three-axle trucks (anticipated to be designed by the farmers themselves) are as follows:

1. The regulating authorities indicate that flexible pavements and thin-oil bound secondaries would not stand up to the increased flexing and scuffing created by three-axles.
2. The testing has shown very poor inter-axle weight distribution and load transfer capabilities in the case of three-axles.
3. The centre of gravity of the load in the case of three-axles tends to be very high thus, lending to vehicle instability and a greater chance of rolling over.
4. The engineering criteria used in designing the three-axle trucks calls for very heavy front steering axle loads (to maintain steering control) much heavier frames, suspension, etc. The tire wear would be approximately twice as great as that of a tandem because of tire scuffing.
5. The three-axle system (add-on axle to an existing tandem suspension) is only workable if it is properly designed and installed by knowledgeable personnel i.e., truck manufacturers. It would involve using a steering lift axle in conjunction with a heavier frame and large capacity steering axle.
6. Three-axles could only be used in those areas where highways are built on concrete and strong subgrades. Alberta highways (primary and secondary) are built on soft subgrades and therefore would not be able to withstand the stress created by three-axles.
7. A new three-axle truck would require significant investment, a situation which would not be in the best interest of farmers especially when the utilization level of such vehicles on the farm is very low.

Based on some of the information obtained from farmers, use of a tandem truck on an average farm is about 180 hours per year. If for example, a tandem is replaced with a three-axle, total savings in terms of gasoline and driving time do not amount to much as depreciation, interest and repair costs increase with higher investment. Moreover, the amount saved by farmers switching to three-axle trucks is not sufficient to offset the additional costs associated with the repairing of secondary highways, thin oil surfaced and other local roads resulting from the use of three-axle trucks. It has been estimated that repairs

and maintenance for these roads range anywhere from $1,000 to $5,000 per kilometre depending upon the road surface. Average annual maintenance costs for gravel roads have been estimated at $1,250 per kilometre. It has been stated that there is a potential for damage to roadways if three-axles are used. In short, the additional repair costs cannot justify the use of farm built three-axle trucks in Alberta.[3]

The highway regulating authorities in the province are very much aware of the producers' concerns regarding increasing transportation efficiencies through minimizing shipping costs. However, they would not allow the use of three-axle trucks because of the potential for damage to the highways and thin-oil surfaced roads. Rather, there have been a few suggestions regarding alternatives to the three-axles through which transportation efficiencies can be achieved or overall transportation costs can be reduced.

About five years ago, the Alberta Motor Transport Board held discussions with the representatives of the counties and municipal districts on the use of three-axle trucks and the problems of overloading tandems. The main objective of such discussions was to accommodate some of the demands by farmers to increase the payload during the peak harvest season. As the counties and municipal district representatives would not agree on the suggestions, the Board decided not to allow the use of three-axles and the overloading of tandems. Furthermore, the local government representatives emphasized that if the government allows the use of three-axles or the overloading of tandems, it would have to be reponsible for the local road maintenance and repairs[3].

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[3] Personal communication with the Alberta Motor Transport Board.

SECTION IV

ALTERNATIVES TO SINGLE-AXLE AND TANDEM TRUCKS

It is difficult to suggest or propose alternatives to replace single-axles or tandem trucks because of the diversity of the farming operations in Alberta. Each farmer's trucking needs are quite different because of the size of the farm, types of farm enterprises and distance to the market, i.e., delivery points. Most farmers have a combination of vehicles, e.g., pick-ups or half-ton, three tonne, single-axles and/or tandems and possibly some other vehicle configurations. With the increase in travelling distances to market farm produce and the increase in gasoline prices, producers' truck requirements have changed over the years. Producers are very much interested in buying fuel efficient trucks which could also offer an increase in payload. Their ultimate objective is to minimize transportation costs by all means and deliver produce more efficiently and promptly to the market outlets.

Because of the restricted or limited use of larger trucks on and around the farm together with their higher purchase price, many producers do not have a wide choice for larger trucks. As such, a few choices are presented below whereby producers can improve their overall transportation efficiency without a huge investment.

1. Add-on Type of Three-axle: This is one of the possible alternatives that producers have been requesting of the transportation authorities. According to some farmer representatives, a farmer could change his tandem to three-axle without a large investment. The highway regulating authorities, engineers, and representatives from the municipalities and counties have expressed reservations about the use of three-axles because of the damage potential of these trucks to secondary highways, thin oil surfaced and local roads and bridge structures. Moreover, the argument by producers that this conversion can be done on the farm does not have the support of the highway authorities who readily point to the safety problems and other potential hazards associated with the use of such vehicles. Therefore, this alternative has to be discounted and does not warrant any further evaluation. Also the addition of an axle to a

tandem would cost about $3,000 to $6,000. A factory built three-axle would cost about $67,000, an investment that the average farmer would find quite difficult to justify. Because of these problems and those highlighted in the previous section, further discussion is focussed on other alternatives to three-axle trucks.

2. Tandem and a Pup: Tandem trucks are preferred over single axles because it is the axle load repetitions which dictate the type, quality, and thickness of highway surface components. Single axle trucks would have almost double axle load repetitions when compared to tandems. Hence, a tandem truck is generally far less demanding on pavements than the same nominal single weight axle. The service life of highway pavements, both asphalt and cement concrete are influenced by axle weights and the number of axle load repetitions.

When the question of increasing the payload for agricultural produce at least cost was raised with the highway authorities, the response was to add a pup to the tandem. The argument here is that if a producer can haul a 12 to 14 tonne load with a tandem, a pup carrying 6 to 8 tonnes would increase the overall payload per trip or per load to about 18 to 22 tonnes. Most of the gravel trucks in the cities have been pulling pups of various lengths with the payload for this combination ranging from 18 to 30 tonnes depending on the size of the pup. One of the main concerns with this type of configuration is the manoeuvrability of the truck and pup in confined spaces. But the open space on and around the farm would be quite alright. Therefore, if gravel trucks can pull these pups on city streets, then it should not be a major concern on county and local roads. However, the only set back in pulling a pup behind a tandem is the size of the motor. If a tandem is not designed for pulling a pup, it would require modifications to the break system which could be fairly expensive.

Tandem and a pup configuration should cost much less than buying a bigger truck. Pups used by gravel truckers could be bought second hand at a significantly lower price and with some repairs could

serve the purpose. Moreover, these pups can last longer because of the relatively low utilization level of the pups on the farm. Finally, tandem and a pup configuration would be much less demanding on pavements because of the reduction in the axle load repetition. This configuration also does not pose any safety problems. Prices for new grain pups (10 to 16 feet) range from $10,000 to $14,000. Used gravel pups can be purchased at a lower price.

3. Truck-Trailer Combination: Truck-trailer combination offers the best payload over the tandems and three-axles. It also offers the lowest per unit cost if used adequately. Although this type of configuration has the best cost advantage over the vehicles presently owned by farmers, investment requirements and lower utilization level by individual farmers make truck trailer combinations more expensive. Large investment would only pay off if the equipment is used extensively over its life span. With the exception of some large commercial farmers proper utilization of truck-trailers would be very difficult to justify, especially on smaller farms. Besides large farm operations, other farmers could make such investment only if they intend to use such trucks for commercial purposes. For example, hauling farm products for other farmers or using the truck for custom hauling. Producers who use tandems for only about 180 hours per year would not be able to justify an investment of $70,000 to $90,000 to buy larger trucks.

4. Commercial or Custom Trucks: One obvious alternative for relatively small truck owners is to engage commercial or custom truckers for long distance hauling.

A comparison of commercial and farm truck costs shows that where the average hauling distance is greater than 29 kilometres (18.1 miles), commercial trucking is less expensive than farm trucking because of net payload. For example, at 50 kilometres (31.3 miles) the commercial truck rate is 25 per cent cheaper than farm truck costs.

In addition to commercial trucking of agricultural produce, there is another type of agricultural produce hauler known as "custom trucker". A "custom trucker" is a farmer who has acquired a larger truck for his own operation and in addition, hauls for other farmers in the area. For such cases, the arrangement between the two parties is quite informal with payments made either in cash, in the form of exchanged labour, or some other kind of barter.

5. Twin Steer Tandem: The use of a twin steer tandem drive truck, pulling a three-axle wagon trailer would offer a potential payload of 37 to 38 tonnes. However, the cost of such a unit is quite high somewhere between $100,000 to $110,000, and does not include the trailer unit. The inclusion of the trailer unit would mean an additional cost of about $20,000.

Again, the ultimate cost for a twin steer tandem would depend on its utilization level. The advantage of this equipment is that it is very versatile in its design, enabling it to haul potatoes, beets, grain, etc. During the winter and spring seasons the unit can be converted to haul grain and fertilizer while in summer it can be used to haul gravel or any other available commodity.

SECTION V

CHANGES IN GRAIN HAULING REGULATIONS

In view of the concerns of producers regarding increasing payload on farm trucks, the minister of transportation has announced amendments to the grain hauling regulations effective August 15, 1984. Changes in regulations were made to recognize the needs of the agricultural community in the hauling of field produce from the field to farm storage (appendix II).

Under the revised regulations a tolerance of 1,000 kilograms (2,200 lb) will be permitted over the legal axle load on each axle of the hauling vehicle (appendix III). In addition, tolerance on the allowable gross vehicle weight has been increased from the present 5 per cent to 15 per cent, to a maximum of 2,000 kilograms (4,400 lb).

These changes apply only to vehicles travelling on gravelled primary highways and on secondary and local roads within improvement districts. All roads under municipal, county or special area control will remain the responsibility of the local road authority.

In making the announcement, the minister of transportation said he will be encouraging the municipal districts and counties to adopt similar weight allowances on gravelled roads under their jurisdiction. He further stated,

> "It is necessary to maintain the existing weight restrictions on paved roads both under provincial and municipal control because of the severe damage that occurs to paved roads when grain trucks are overloaded."

These changes will be effective on August 15 of each year and remain in effect until the completion of the harvest and should help to resolve some of the problems that farmers face in getting the crop to the bin.

The above changes in the grain hauling regulations will enable producers to increase payload on tandems by about 2 tonnes, resulting in a reduction in the number of trips from the field to storage as well as reduced transportations costs. Although the extent of such savings is quite difficult to measure, it is certainly an improvement over existing hauling regulations.

Details regarding an order governing the weights allowed for public vehicles on highways under the Motor Transport Act are provided in appendix IV of this report. Information on maximum weight schedule for steering and carrying axles configuration of axle groups, and acceptable axle combinations are also given in this appendix.

SECTION VI

SUMMARY AND CONCLUSIONS

Summary

Alberta farmers are faced with a difficult choice when it comes to the transportation of farm produce. Most farmers have been using single-axle trucks to haul farm produce to the markets and/or processing facilities. With the closure of a sugar beet refinery at Picture Butte and some beet receiving stations, hauling distances for beet producers have increased significantly. Therefore, in order to minimize shipping costs, farmers have no choice but to switch to larger trucks or hire commercial or custom truckers to haul their produce.

In view of rising fuel prices, farmers in southern Alberta (specifically beet and potato growers) have expressed interest in increasing the size of their tandems so that they could increase the payload by 3 to 5 tonnes. They proposed the addition of another axle to the tandem, thus making it a three-axle truck. A cost comparison between a tandem and the farm built three-axle does not show any significant cost savings of the latter. Moreover, on-farm conversion of a tandem to a three-axle is not considered safe for highway driving. The highway regulating authorities have also indicated several difficulties with the suggested three-axles. Because of these difficulties they would not allow the use of such trucks on Alberta primary/secondary highways, gravel and thin oil surfaced roads.

For the benefit of farmers, the government has revised its regulations resulting in an increased tolerance on the allowable gross vehicle weight from the present 5 per cent to 15 per cent up to a maximum of 2,000 kilograms (4,400 lb). Such a revision has also allowed for an increase in tolerance of 1,000 kilograms (2,200 lb) per axle weight loading. At present, changes in loading regulations only apply to hauls from the field to storage.

The provincial government has encouraged local authorities to allow farmers to increase their payloads under the above guidelines. As maintenance and repairs of secondaries, thin oil surfaced and gravel

roads are the responsibility of the local governments, it is up to them to decide on any increases on axle loads on these roads.

Although comparison of operating costs favors the use of a three-axle truck (farm built) over a tandem for the same volume of traffic, it cannot be licensed for use because of damage potential to roads. Furthermore, high investment requirements for a three-axle truck would be difficult to justify. The highway regulating authorities cannot unilaterly authorize the use of three-axle trucks without the consent of local governments. They have argued that the extensive damage to roads as a result of using three-axles does not justify the licensing of these trucks. Expenditures to maintain roads in proper conditions would be significantly higher than the cost savings accruing to a small group of producers. As such, the issuing of licenses for three-axles would not be permitted.

Conclusions

The present situation does not allow the use of farm built three-axles for transporting agricultural produce because of the concerns expressed by the highway authorities. Producers interested in increasing truck payload should, therefore, consider one of the following alternatives:

1. Single axle truck owners should consider buying tandems if requirements warrant;
2. Tandem truck owners should consider adding a pup. If a tandem is not designed for pulling a pup, it would require modifications to the brake system. These modifications would certainly incur some expenditures. Therefore owners of tandem trucks are advised to obtain estimate of expenses for modifications before purchasing a pup.
3. Group of producers should consider joint ownership of a truck trailer. This type of ownership would require working out details in regards to the operation and maintenance of the unit.
4. Hire a custom or commercial trucker. A custom or commercial trucker with proper equipment represents the best potential for savings in

transportation costs especially for longer hauls.

5. Commercial farming operations should evaluate the use of twin steer tandems.

Suggestions And Recommendations:

1. It is suggested that the government and the agricultural community examine the "California transportation system" where a trucking contractor has a large number of trucks and trailers especially built to handle produce. The trucking costs under this system are considerably lower.

   California only allows a maximum gross weight of 36,000 kg (80,000 lbs.). In Alberta, with a gross maximum weight of 53,500 kg (118,000 lbs.) the above system offers a great potential for cost savings if a commercial trucker is supported by the agricultural community.

2. A task force comprising of representatives from the provincial government (Agriculture, Alberta Transportation, Alberta Motor Transport Board) and producer groups, should be appointed to study ways and means of examining the potential for reducing transportation costs and increasing overall transportation efficiencies for hauling farm products and supplies.

APPENDIX I

Study Aims For Uniform Truck Rules

In the fall of 1983, the Federal and Provincial Governments announced a three-year, $2.8 million research program on truck dimensions as an aid to developing more uniform regulations for trucks operating on interprovincial highways.

The main objective of the research program is to obtain information about the behavior of heavy trucks and to present the findings to authorities with recommendations for greater uniformity in regulations. The research would look at vehicle stability and control and the effect of vehicle types on highway pavements. It would include computer simulation of different types of vehicles by the University of Michigan's Transport Research Institute.

The group responsible for this research program is also studying the performance of three-axles and other heavier trucks on different types and grades of roads in various parts of Canada. The findings on these trucks would be included in the report to be submitted to the Council of Ministers responsible for transportation and highway safety.

The program was initiated by the Council of Ministers responsible for transportation and highway safety and is being carried out by the Canadian Conference of Transport Administrators and the Roads, and Transportation Association of Canada in cooperation with the trucking industry.

Trucking comes under provincial jurisdiction in Canada and the regulations of one province differ significantly from another. Each province sets its own regulations based on climate, geology, road construction practices and concern for safety. For example, western provinces permit longer over-all vehicle combinations, while eastern provinces allow higher gross weight limits.

It is anticipated that the research program presently underway on trucking would address some of the concerns raised by different interest groups.

APPENDIX II

Alberta NEWS RELEASE

GOVERNMENT OF ALBERTA

P.C. NO. 84-347

ALBERTA TRANSPORTATION

RELEASE DATE: AUGUST 15,1984

HAULING GRAIN REGULATION CHANGES ANNOUNCED

EDMONTON -- Alberta Transportation Minister Marvin Moore announced today regulation changes, effective August 15, 1984, recognizing needs of the agricultural community in hauling field produce from the harvest field to farm storage.

Under the revised regulations, a tolerance of 1000 kilograms (2200 lbs.) will be permitted over the legal axle load on each axle of the hauling vehicle. In addition, tolerance on the allowable gross vehicle weight is increased from the present five percent to 15 percent, to a maximum of 2000 kilograms (4400 lbs.).

The changes apply to vehicles travelling on gravelled primary highways and on secondary and local roads within Improvement Districts. All roads under Municipal, County or Special Area control will remain the responsibility of the local road authority.

In making the announcement, Mr. Moore said he will be encouraging the Municipal Districts and Counties to adopt similar weight allowances on gravelled roads under their jurisdiction.

Mr. Moore stated, "It is necessary to maintain the existing weight restrictions on paved roads both under provincial and municipal control because of the severe damage that often occurs to paved roads when grain trucks are overloaded."

This increase in axle loading and gross vehicle weight should help to resolve some of the problems that farmers face in getting the crop to the bin. The changes will begin each year on August 15 and will run until the completion of harvest.

REFERENCES:

Minister of Transportation
423 Legislative Building
Edmonton 403/427-2080

Keith Walker
Motor Transport Branch
Red Deer 403/340-5430

TRANSPORTATION

Office of the Minister

423 Legislature Building, Edmonton, Alberta, Canada T5K 2B6 403/427-2080

August 15, 1984

To

Alberta Association of Municipal Districts & Counties

Dear Sir:

In recognition of specific concerns from the agricultural community, regulations governing weights of field produce being transported from harvest field to farm storage have been amended to allow for increased payloads between August 15 of each year until the completion of harvest.

Under the revised regulations, a tolerance of 1000 kilograms (2200 lbs.) will be permitted over the legal axle load on each axle of the hauling vehicle. In addition, tolerance on the allowable gross vehicle weight is increased from the present five percent to 15 percent, to a maximum of 2000 kilograms (4400 lbs.)

The changes will apply to vehicles travelling on gravelled primary highways and local roads within Improvement Districts. Recognizing that control and management of municipal roads has been delegated to local road authorities, I would encourage you to extend the same privilege to farmers hauling field crops on gravelled rural roads within your jurisdiction.

I have enclosed a copy of the news release, the Motor Transport Board Weight Order 84-D-1 as well as a suggested amendment to your local weight order for your reference.

If you have any questions or require further clarification, please contact any Vehicle Inspection Station, District Office of the Motor Transport Branch or the Motor Transport Branch in Red Deer.

Yours truly,

Marv Moore

MARVIN E. MOORE
Minister of Transportation

Attachment

APPENDIX III

APPENDIX III

A Better Way - Axle Weight Program

Loads Based On Gross Vehicle Weight

Highway load limits in Alberta have been primarily based on gross vehicle weight (GVW). As long as a vehicle GVW was within the designated load limit for a particular road, excessive weight could be concentrated on any axle. Tests done on various roads showed that this poor distribution of heavy weights caused serious damage to the road surface.

On many roads in the province, this load control system allowed for the movement of trucks with overloading single axles, which do substantial damage, yet disallowed the movement of truck-trailer conbinations which though heavier in GVW and with proper weight distribution are more efficient and cause less road wear and damage.

Tests have shown that if an axle carries 10 per cent or more weight than it was designed for it almost doubles the damage done to roads. After careful consideration, the highway authorities have changed load limits from GVW to axle loading.

Change From Gross Vehicle Weight To Axle Loading

Loading enforcement within the province is no longer based on gross vehicle weight. Rather the weight is considered on axle instead. Axle loading or axle weight control provides a better relationship between vehicle loading and road wear and damage. Moreover, this system of loading provides more equal development opportunities for areas in the province where limitation were previously imposed using GVW criteria. It is anticipated that a new system of loading (axle) would result in more efficient use of trucks.

As stated in the Motor Transport Board information pamphlet on "A Better Way - Axle Weight Program", controlling weights on axle will provide more protection to roads against wear and damage. Furthermore, removing gross vehicle weight limits on highways and roads will open up more roads to higher payload vehicles with multi-axle configurations.

The new system of axle loading offers two major financial benefits:

1. It will help the province and local authorities reduce costs of repairing damage caused by vehicles with overloaded axles.
2. Through the increased use of better designed, and higher payload vehicles with more axles, the cost to industry and hauling companies for moving commodities and equipment will be less.

APPENDIX IV

Alberta
TRANSPORTATION
Motor Transport Branch

4th Floor, Provincial Building, 4920 - 51 Street, Red Deer, Alberta, Canada T4N 6K8

ORDER NO. 84-D-1	)	AUGUST 1, 1984
BY THE DIRECTOR OF	)	IN THE MATTER OF
THE MOTOR TRANSPORT BRANCH	)	WEIGHTS ALLOWED PUBLIC
DEPARTMENT OF TRANSPORTATION	)	VEHICLES ON HIGHWAYS

I, H. Keith Walker, Director of the Motor Transport Branch of the Department of Transportation pursuant to Motor Transport Board Delegation Order AR 98/84, hereby make the Order in the attached Appendix, being an Order to set out maximum allowable weights allowed public vehicles on highways.

This Order rescinds Order No. 83-D-1.

H. Keith Walker, Director
Motor Transport Branch

Information 403/343-5260 • Overload Control 403/340-5139
Prorate 403/340-5230 • Field Operations 403/340-5224 • Telex 038-3250 • TWX 610-841-1058

APPENDIX IV

THE MOTOR TRANSPORT ACT

AN ORDER GOVERNING THE WEIGHTS ALLOWED PUBLIC VEHICLES ON HIGHWAYS

1. In this Order,

(a) "carrying axle" means any axle that is not a steering axle,

(b) "gross weight of a single axle" means the total weight a single axle transmits to the highway,

(c) "gross weight of a tandem axle" means the total weight a tandem axle transmits to the highway,

(d) "gross weight of an axle group" means the sum of the weights transmitted to the highway by all axles within the axle group,

(e) "gross weight of all axles" means the sum of the weights transmitted to the highway by

(i) all of the axles of a vehicle, or

(ii) all of the axles of a combination of vehicles,

(iii) but does not include the weight of towed implements of husbandry

(f) "licensed weight" means the gross weight of all axles for which a public vehicle is licensed,

(g) "maximum allowable weight" means the weight that may be borne by an axle, an axle group or all axles of a vehicle or combination of vehicles as established by Schedule 1 and Schedule 2 of this Order, or a special permit issued under Section 20 of the Motor Transport Act,

(h) "percentage axle weight" means the percentage that is applied to the maximum allowable weights of carrying axles, as established by Schedule 1 and Schedule 2, to determine the weight that they may bear on a highway,

(i) "primary highway" means a highway designated as such under The Public Highways Development Act,

(j) "single axle" means an "axle" as defined in the Motor Transport Act,

(k) "steering axle" means the articulated axle or axle group at the front of a motor vehicle which can be controlled by the driver for the purpose of steering the motor vehicle,

(l) "tandem axle" means any two or more consecutive axles whose centres are more than 1.0 metres but not more than 2.4 metres apart, and are individually attached to or articulated from a common attachment to the vehicle including a connecting mechanism that equalizes the load between axles,

WEIGHT LIMITATIONS

2. No person shall cause a vehicle to move upon a highway when

(a) the gross weight of a steering axle exceeds the maximum allowable weight set out in Schedule 1,

(b) subject to part (g) of this section, the gross weight of a carrying axle or carrying axle group exceeds the maximum allowable weight set out in Schedule 1 or Schedule 2,

(c) the gross weight of a single axle or axle group exceeds the maximum allowable weight for that axle or axle group as determined by the number of tires multiplied by the carrying capacity for the tire size(s) set out in an Order, pursuant to Section 35 of the Motor Transport Act,

(d) the gross weight of all axles of the vehicle exceeds 53,500 kg,

(e) the gross weight of all axles exceeds the licensed weight of a vehicle,

(f) the gross weight of all axles exceeds the posted maximum weight for a bridge,

(g) the gross weight of a carrying axle, carrying axle group or all axles of a vehicle or combination of vehicles exceeds the weight that may be borne on a highway as determined by the percentage axle weight prescribed in an Order, pursuant to Section 35 of the Motor Transport Act or as established by a Municipal District, County, Special Area, City, Town or Village when so authorized by the Minister, or

(h) notwithstanding sections (a) and (b), the gross weight of self propelled equipment exempted from registration exceeds 11,000 kg on a single axle.

TOLERANCES

3(1) A tolerance of 5% up to a maximum of 1,000 kilograms is permited on a vehicle or combination of vehicles above the maximum allowable weight of all axles as per this Order.

(2) A tolerance of up to 500 kilograms per axle is permitted, provided that the licensed maximum gross weight, plus tolerance allowed by subsection (1) is not exceeded.

(3) Subsections (1) and (2) do not apply to a permit issued under Section 20 of the Motor Transport Act.

(4) Notwithstanding subsections (1) and (2), commencing August 15th of each year and ending February 15th of the following year, for the movement of field crops from field to farm storage during harvest operations, where the movement is on gravel roads, including the crossing of paved or oiled roads subject to:

(i) a tolerance of 15% up to a maximum of 2,000 kilograms is permitted on a vehicle or combination of vehicles above the maximum allowable weight of all axles as per this Order.

(ii) a tolerance of 1,000 kilograms per axle is permitted, provided that the licensed maximum gross weight, plus tolerance allowed by subsection (i) is not exceeded.

(iii) the approval of the rural municipality for highways under their direction, control and management.

VEHICLE LICENSE

4. The owner may license a vehicle or combination of vehicles at a weight

(a) not in excess of the gross weight of all axles permitted by this Order, and

(b) not less than 50% of the gross weight of all axles permitted by this Order.

EXEMPTIONS FROM HIGHWAY WEIGHT RESTRICTIONS

5(1) Notwithstanding section 2(g) the following shall be exempt from percentage axle-weights where percentage and weights on a highway are set at less than 100%:

(a) vehicles or combinations of vehicles which do not exceed a total of 5,000 kilograms,

(b) school buses while empty or transporting children to and from school,

(c) rubber tired farm tractors without trailers,

(d) vehicles or combinations of vehicles crossing any highway,

(e) vehicles or combinations of vehicles required by the road authority to transport materials needed for emergency maintenance and repair of highways or roads,

(f) Alberta Transportation vehicles used for testing pavement strength, or,

(g) vehicles or combinations of vehicles transporting fresh milk and cream.

(2) Notwithstanding section 2(g), the following shall be allowed 80% of the maximum allowable weight for carrying axles and carrying axle-groups on highways set at a percentage axle weight less than 80%:

(a) vehicles or combination of vehicles transporting bread, domestic drinking water, Canada Post or heating fuel, and

(b) buses, other than school buses, carrying passengers.

(3) This Order does not apply to snow removal and ice control equipment or motor graders operated by or on behalf of the Department of Transportation or a municipality within the boundaries of its jurisdiction.

(4) This Order does not apply to the movement of equipment to a natural or man-made disaster such as a forest fire, flood, train derailment or pipeline spill. The Motor Transport Branch in Red Deer shall be notified of such movement as soon as practical.

OVERLOAD PERMITS

6(1) No person shall obtain an overload permit for a vehicle when the licensed weight is less than its maximum allowable weight.

(2) No person shall obtain an overload permit to travel over a County, Special Area or Municipal District road without the approval of the County, Special Area or Municipal District.

PERMITS FOR SPECIAL TYPES OF VEHICLES AND LOADS

7. The Board may charge a fee for any special permit issued and such fee may include supervisory costs (if any).

RESPONSIBILITY OF PERMIT HOLDERS

8(1) As a condition of obtaining a special permit, the owner, operator, driver or mover of a vehicle and load shall agree to be responsible for all damages which may be caused to the highways by reason of driving, operating or moving of any such vehicle and load upon the highway outside the conditions of the permit.

(2) The Board may as a condition to the granting of a special permit, require a bond sufficient to cover the cost of repairing possible injury to the highway.

SCHEDULE I (page 1 of 1)

MAXIMUM WEIGHT SCHEDULE - STEERING AXLES

(SINGLE TIRES - 2 WHEELS PER AXLE)

Minimum eqvivalent tire size	* Minimum carrying capacity of tires	Minimum distance from steering axle to adjacent carrying axle	Maximum allowable weight per steering axle (s)
Single Axles			
900 x 20	2 050 kg	3.0 m	4 100 kg
1000 x 20	2 275 kg	3.0 m	4 550 kg
1100 x 20	2 500 kg	3.0 m	5 000 kg
1200 x 20	2 725 kg	3.0 m	5 450 kg
1300 x 20	2 950 kg	3.0 m	5 900 kg
1400 x 20	3 175 kg	3.5 m	6 350 kg
1500 x 20	3 425 kg	3.5 m	6 850 kg
1600 x 20	3 650 kg	3.5 m	7 300 kg
Tandem Axles			
1200 x 20	2 725 kg	5.0 m	9 100 kg
1300 x 20	2 950 kg	5.0 m	10 200 kg
1400 x 20	3 175 kg	5.0 m	11 300 kg
1500 x 20	3 425 kg	5.0 m	12 500 kg
1600 x 20	3 650 kg	5.0 m	13 600 kg

* Tire carrying capacity as stated in TIRE WEIGHT CHART under an Order pursuant to Section 35 - Motor Transport Act

Note: 1. Dimensions may be rounded to the nearest tenth of a metre.
3.64 m = 3.6 m 3.56 m = 3.6 m

2. Carrying axles equipped with single tires (2 wheels per axle) shall be considered as steering axles.

SCHEDULE 2 (page 1 of 4)

MAXIMUM WEIGHT SCHEDULE - CARRYING AXLES

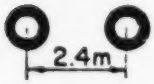
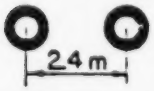
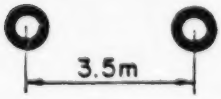
(DUAL TIRES - 4 WHEELS PER AXLE)

Note: 1. All dimensions shown for carrying axles may be rounded to the nearest tenth of a metre.

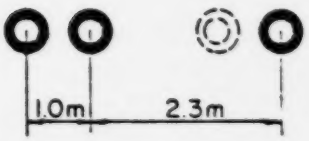
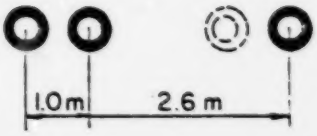
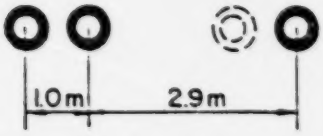
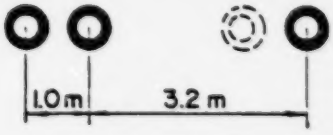
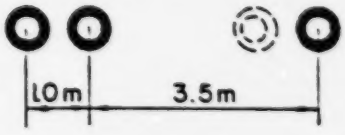
2.44 m = 2.4 m 2.36 m = 2.4 m

2. Steering axles equipped with dual tires (4 wheels per axle) shall be considered as carrying axles.

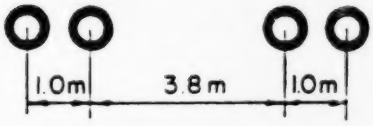
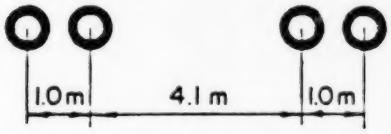
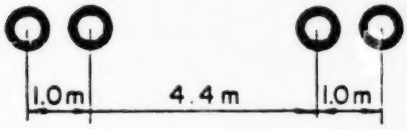
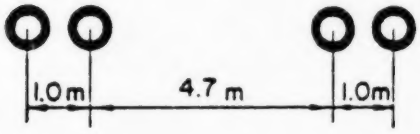
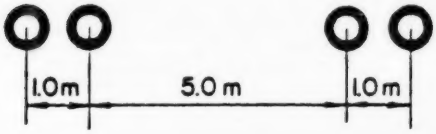
3. Minimum dimensions for carrying axles are indicated.

Configuration of Axle Group	Maximum Allowable Weight Per Axle Group
Single axle	
	9 100 kg
Tandem axles	
	16 000 kg
	16 400 kg
	16 800 kg
Two single axles	
	16 000 kg
	16 800 kg
	17 200 kg
	18 200 kg

SCHEDULE 2 (CON'T) (page 2 of 4)

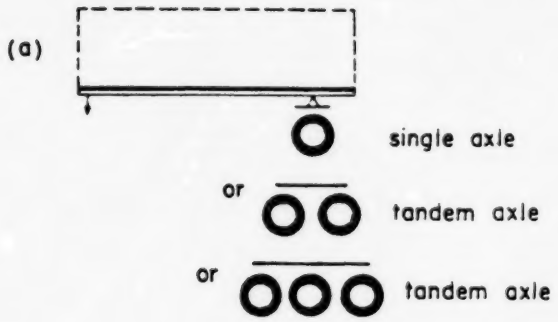
Configuration of Axle Group	Maximum Allowable Weight Per Axle Group
Tandem Axle with Single Axle	
	19 500 kg
	20 900 kg
	22 300 kg
	23 700 kg
	25 100 kg

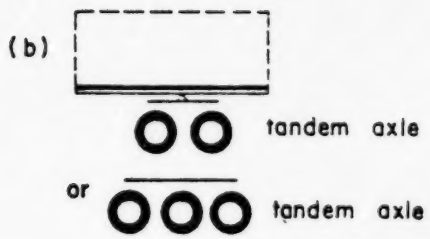
SCHEDULE 2 (CON'T) (page 3 of 4)

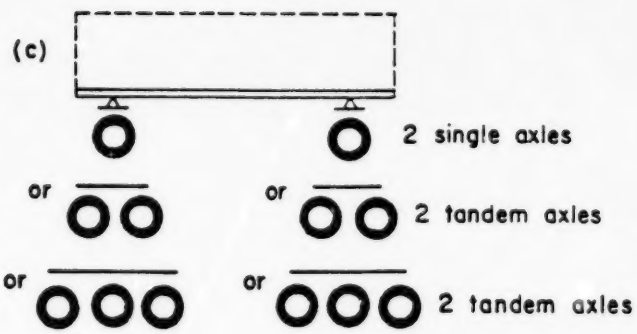
Configuration of Axle Group	Maximum Allowable Weight Per Axle Group
Two Tandem Axles	
	26 400 kg
	27 800 kg
	29 200 kg
	30 600 kg
	32 000 kg

ACCEPTABLE AXLE COMBINATIONS

The axle combinations shown below shall be the only combinations acceptable for registration in these regulations.







(any combination of two can be used)